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USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 115

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USSR REPORT

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 115

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UDC 621.314.25:621.3.037.3

PFKR-1 HIGH-SPEED RADIO PULSE PHASE-TO-CODE CONVERTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 22 Feb 82) p 208

OTCHALKO, V. F. and BADAGAROV, B. A.

[Abstract] A high-speed device has been built for converting the phase shift of continuous and radio pulse signals into a parallel binary code. This PFKR-1 converter can be used as interface between radio channels and a computer, or for measuring the transient phase characteristics of radio-electronic equipment components, or for determining the parameters of signal phase modulation. The device employs an intermediate conversion of phase shift to voltage, by doubling the phases of frequency-independent orthogonal signal components and subsequently doubling the signal frequency, followed by voltage-to-code conversion with the aid of continuous-logic functions. The maximum amplitude of input signals is 0.5 V, their dynamic range is 40 dB and frequency range is 20-40 MHz. The access time to a signal is 390 ns, the conversion time is 550 ns with a repetition rate of 2.5 MHz. The nonlinearity of the phase characteristic is within 2° rms, the rms frequency error is 1° and the rms amplitude error is 1.5°. The device is built with series 130 integrated microcircuits. For operation with radio pulses the converter is synchronized by an external pulse. The device operates from a 220±5% V line, drawing a power of 100 W. Figures 1. [287-2415]

UDC 621.317.795.3

WIDE-RANGE PULSE-DURATION ANALYZER FOR ELECTRICAL AND OPTICAL RANDOM PULSES IN CAMAC STANDARD SYSTEM

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 7 Jul 82) pp 207-208

DANILEVICH, V. V. and KVACHËNOK, V. G.

[Abstract] A pulse duration analyzer has been built for electrical and optical random pulses of $5 \cdot 10^{-3}$-5 V and 10^{3}-10^{7} cd amplitude respectively.

Readings are referred to a priori unknown amplitudes. The analyzer operates according to two methods, with modified threshold tracking for short pulses of 10^{-7}-10^{-6} s duration and with individual pulse prediscretization (32 levels) of long pulses of 10^{-6}-10^{-1} s duration. In the latter case the pulse duration is determined through computation, from the pulse envelope restored near its given relative level (0.1-0.7). The measurement error does not exceed 3% within the 1:5 dynamic range of amplitudes. The analyzer is assembled in a single crate of CAMAC terminal modules. For optical pulses it also contains a photoreceiver with a set of corrective and neutral filters. It operates either independently with a "Consul" typewriter or on-line with a computer. It operates from a 220±10% V-50 Hz line, drawing 350 VA. Figures 1.
[287-2415]

UDC 621.317.799

INSTRUMENT COMPLEX FOR MEASURING WEAK SIGNALS FROM RECEIVER ARRAY

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 22 Jun 82) p 204

KATUSHONOK, S. S., KUDALENKIN, V. V., LIVSHITS, M. G. and SHUSHKEVICH, S. S.

[Abstract] An instrument complex has been built for measuring the parameters of solid-state photoelectric image receivers in arrays of coordinate-sensitive elements. It consists of three self-contained modules: video monitor, synchronizer with controls, and amplifier-converter of input signals. The video monitor is based on a standard television receiver with a 32 cm screen. The sweep here is produced by frame and line synchronizing signals, the beam intensity is modulated according to a 5-digit binary code. The signals from photoreceiver elements are sequentially converted to a 12-digit binary code. The mean level of a signal from a selected receiver element is measured with 0.1% accuracy and displayed on a digital panel with a format variable from 64x64 minimum to 256x256 maximum. The conversion time is 20 μs/element, the memory capacity is 2^{16} 5-digit words. The instrument complex can, with slight modifications, also be used for visual display of thermograms and for measuring the electrical characteristics of solid-state image transmitters in television transmitter equipment. The components are assembled in standard "Nadel'" cabinets. The complex operates from a 220 V-50Hz line, drawing a power of 1 kW. Figures 1.
[287-2415]

UDC 621.378.9

SPLIT CONNECTORS FOR SINGLE-FIBER AND FIBER-BUNDLE OPTICAL CABLES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83
(manuscript received 23 Dec 81) pp 178-180

DMITRIYEV, V. K.

[Abstract] A split connector has been developed for joining single-fiber or fiber-bundle optical cables. It contains two lugs for the two ends to be joined and a cam slipped over each lug and placed inside a sleeve as shield against distortion during adjustment of the cable joint. The sleeves are held together by three flat cover plates, the latter held in place by compression springs inside the retainer. This ensures a precision cable joint, with the eccentricity of the cams not exceeding 1 μm/degree. The connector is universal, inasmuch as it has been designed for any fibers up to 0.2 mm in diameter and the sleeve assembly inside the retainer is suitable for cable joints on either transmitter or receiver side, single fibers being used when the radiation source is a semiconductor laser and fiber bundles with larger aperture being used when the radiation source is a light-emitting diode. In addition, a comb fixture with rectangular lengthwise grooves and a V-groove across has been developed for stacking and aligning fiber bundles with a pin rolled by a moving plate on top. The radiation losses in such a connector are equivalent to an attenuation of 1.9 dB/joint minimum, 5.6 dB/joint maximum, and 3.5 dB/joint on the average. Figures 2; references 4: 2 Russian, 2 Western.
[287-2415]

UDC 621.391.2

SPECTRAL DENSITY ANALYZER OF CONTINUOUS AND PULSE SIGNALS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83
(manuscript received 4 Jan 82) pp 206-207

GORBUNOV, A. I., LYKOV, Yu. I., OVCHARUK, V. N. and OSTRITSKIY, A. S.

[Abstract] An instrument has been built for analyzing the spectral power density of continuous signals and the spectral amplitude density of pulse signals generated by acoustic emission from solid media. It operates according to the principle of simultaneous frequency analysis at fixed points. The incoming acoustic emission signal is first amplified, then passed through a set of 30 narrow-band filters, and detected. An average(rectified)-value detector is used for continuous signals, a peak-value detector is used for pulse signals, the analyzer scales having ranges of 0.003-600 $\mu V/\sqrt{Hz}$ and 0.001-20 μV/Hz correspondingly. The dynamic range exceeds 30 dB. The readings can be displayed either on an oscilloscope or a recording instrument,

or fed to the analog-to-digital converter of a memory. The latter consists of two independent modules, each with a capacity of storing 32 spectrograms. The recording instrument is activated either automatically by a synchronizing pulse or manually by pressing a pushbutton. The analyzer can be adapted, by means of appropriate instrument transducers, for any fast physical process within the 0.03-1 MHz frequency range. It operates from a 220 V line, drawing 200 VA.
[287-2415]

UDC 681.3.01:621.372.5

DIGITAL SPECTRUM ANALYZER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 26 Apr 82) p 206

ALEKSEYENKOV, Yu. F., BOBKO, G. M., BUROV, V. A., DEGTYAREV, V. V. and USTENKO, S. V.

[Abstract] A digital spectrum analyzer has been built for analysis, in real time, of signals in the 0-25.6 kHz frequency range. The instrument performs a discrete Fourier transformation with adjustable frequency resolution (0.1-100 Hz). A spectrum can be averaged according to a linear or exponential algorithm, with a rectangular Henning window used as weight function. Any spectral component or region of the spectrum irrelevant to the analysis can be excluded from calculations, to shorten the computation time. The instrument contains a built-in K580 microprocessor for analyzer control, data processing, and alphanumeric data display on the screen ofaa cathode-ray tube along with the display of signal histograms and envelopes to a linear or logarithmic scale. From 1 to 1024 readings can be averaged, whereupon the maximum value of a spectral component can be determined. The analyzer has an input impedance of 1 Mohm and a dynamic range of 60 dB. Figures 1.
[287-2415]

UDC 681.326

SYSTEM FOR AUTOMATED PARAMETRIC INSPECTION OF DIGITAL EQUIPMENT MODULES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83
(manuscript received 15 Mar 82) p 205

TASHLINSKIY, A. G, and BORISKIN, L. P,

[Abstract] A system has been built for automated inspection of digital equipment modules by the parametric method. It contains a simulator of pulses applied to the input of such modules, for measurement of amplitude and time parameters of continuous or pulse signals in such equipment under simulated actual operating conditions. The system can apply to any terminal of a digital module a packet of 1-511 rectangular direct or inverse pulses as well as continuous pulse trains of given pulse duration (100-600 ns) and repetition rate (2500-50 kHz). The voltage level (0.02-5 V of pulses longer than 100 ns), the pulse amplitude (0.02-5 V) and pulse duration (0.05-5 μs), the time delay (0.03-5 μs), and the current (0.25-50 A with up to 75 mV across the shunt) can be measured either manually or automatically under a given electrical load ranging from 1 to 30 units (1.6 mA corresponding to a logic "0", 40 mA corresponding to a logic "1"), such a load being simulated by series K113 transistor-transistor logic. The absolute errors do not exceed 20 mV (voltage level), 50 mV (pulse amplitude), 10 ns (pulse duration and time delay), and 0.25 A (current). The measurement time is not longer than 15 μs for voltage level and pulse amplitude, not longer than 6 μs for pulse duration and time delay. All data on measured parameters and the inspection program are presented in a 9-digit binary code. After measurement of one parameter, the system selects the corresponding "acceptable" or "reject" signal and thus controls the inspection process. The system is contained in a 484x525x855 mm^3 cabinet. It operates from a 3-phase 220 V - 400 Hz line, drawing a power of 70 W. Figures 1.
[287-2415]

UDC 681.3:3.324+681.5+621.317.39+621.039

BUS-MODULAR MULTIPROCESSOR MEASUREMENT-AND-CONTROL SYSTEMS (REVIEW)

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 14 Apr 82) pp 7-20

ERGLIS, K. E.

[Abstract] Because the feasibility of building multiprocessor systems in a single crate had been established and software as well as hardware for their versatile modes of operation had been developed in the 1975-77 period, bus-modular multiprocessor measurement-and-control systems were produced in various countries along with appropriate standards. These systems feature algorithms of parallel communication between crate buses, standard communication equipment, setting and functionality of registers in interfaces between bus and modules, module design with common layout of digital and analog devices in one module or in various modules of one crate, means of digital and analog data input/output, power supply for digital and analog circuits, and means of programmable system generation, especially geographical addressation. The parameters of power supplies as well as tolerances on these parameters and on the loads have been determined. The hardware of these systems meets the requirements of extraordinary flexibility and versatility in three basic applications: at fixed location, on board of vessels, in production. They contain high-speed automatic subsystems for scientific research, computer-aided design, technological process control and inventory control. They are organized so as to provide for geographical addressation and interfacing with conventional computers. Such systems are CAMAC (EUR-6500 Standard, ESONE+NIM), KTS LIUS-2 (Special Design Office for Automatic Control Systems, Kharkov), EUROBUS (DSWP-7232 Standard, MOD+Ferranti), E3Z (ESONE Small System Standard), MULTIBUS (IEEE-796 Standard, with I-41 interface to SM-1800 microcomputers, USSR Institute of Electronic Control Machines), P896 (IEEE+European Distributed Intelligence Study Group), FASTBUS (NIM), FLEXBUS (IEC Standards), VERSABUS Module Europe (with PRI priority, RRS round robin select, or ONE single-level arbiters, joint USA and European project). These systems are compared with respect to layout and size, type of connectors and contacts, cycle length, crate wiring, and addressation including logic and registers. Figures 1; tables 1; references 26: 2 Russian, 24 Western (2 in translation).
[287-2415]

UDC 621.383.52

PHOTORECEIVERS WITH PRESCRIBED SPECTRAL CHARACTERISTICS USING $GaAs_{1-x}P_x$ DEVICES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 11 Jan 82) pp 169-170

GOROKHOV, V. A., IL'IN, Yu. L. and POPOV, R. A., Leningrad Institute of Electrical Engineering

[Abstract] Photoreceivers with surface-barrier structure have been producing using $GaAs_{1-x}P_x$ as semiconductor material with a forward energy gap adjustable over the 1.43-2.77 eV range. These structures were grown by the Berg-Dean method on epitaxial layers of n-type gallium arsenide and gallium phosphide oriented in the (100) plane, with electron concentrations of 10^{16}-10^{17} cm^{-3}. Surface barriers were produced by chemical precipitation of gold or by vacuum deposition of gold film on semiconductor substrate. Ohmic contact tabs with an electrical resistivity not exceeding 10^{-4} ohm·cm^2 were added by chemical and then electrochemical precipitation of 50-2000 nm thick Au, Ni, Sn layers with subsequent fusion in a hydrogen stream at 773-823 K. The long-wave sensitivity edge can be regulated by varying the composition of the olid solution, the short-wave sensitivity edge can be regulated by means of optical filters serving also as photoreceiver entrance windows. The spectral characteristics of the short-circuit photocurrent of such photoreceivers, $GaAs_{0.68}P_{0.32}$ being a typical material, with various selenium-cadmium glass filters illustrate this. Figures 2; references 4: 2 Russian, 2 Western (1 in translation).
[287-2415]

UDC 537.226:541.133:621.317

ELECTROOPTIC PULSE-TYPE HIGH-VOLTAGE BRIDGE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 8 Apr 82) pp 94-97

OVCHINNIKOV, I. T. and YANSHIN, E. V.

[Abstract] An electrooptic pulse-type high-voltage bridge is described which has been designed for measuring the electrical conductivity of electrolytes and liquid dielectrics as well as its dependence on the electric field intensity. Its four arms are two orthogonally oriented Kerr cells and two capacitors, a measuring capacitor in series with one cell and a compensating capacitor in series with the other. The source of voltage pulses in an Arkad'yev-Marx generator built with ceramic capacitors and rated for 30 kV. The light beam from a ruby laser passes through the two Kerr cells successively (after having passed through an objective, a quarter-wavelength plate, and a diaphragm with two 90° deflections by mirrors along the path), is reflected back through the Kerr cells, and passes through the same diaphragm but then through another objective, an analyzer, and an FEK-17 photodetector to an S7-10B recording oscillograph. The oscillograph is characterized by small pickup, below its 10 mV sensitivity threshold. The sensitivity threshold with respect to the difference between the two capacitor currents is lowest when both capacitances are equal and becomes independent of the dielectric permittivity of the tested liquid at voltage pulses of 10^5 V, with the time averaging interval (discretization step for numerical differentiation in the expression for change in electrical conductivity as function of time during compensation process) ranging from 10 ns to 1 ms. The bridge can also be used for measuring high-voltage emission currents, current-voltage characteristics of conductors and semiconductors, permittivity saturation of dielectric and ferro-electric materials, and for study of prebreakdown processes. Figures 2; references: 5 Russian. [287-2415]

UDC 621.311.66

DEVICE FOR TESTING HIGH-VOLTAGE SOURCES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 22 Jan 82) pp 118-119

KLYUYKOV, A. G., FEDOROV, V. L. and NAGIBIN, V. K.

[Abstract] A device for checking high-voltage power supplies of electron guns is described, measurements being made with it under an equivalent load. Its high-voltage stage is a transit pentode inside a metal tank filled with transformer oil. The anodes are supplied from a step-up transformer through a diode-bridge rectifier and RC filter. The electric-discharge pump for this pentode is supplied from the same transformer. Another transformer, also in the tank, provides the filament supply. The collector of the pentode is wrapped in a hermetic jacket with two tubes for cooling water. A sheet of lead around the jacket shields it against x-rays. The control stage contains am autotransformer for regulating the anode voltages, a voltmeter, a multirange ammeter, and a protective water-type relay in addition to cut-out fuses. The pentode is protected against sudden loss of voltage by the tested power supply and against overvoltage on the positive busbar under open circuit. The device is suitable for testing voltage sources (2-100 kV) of negative polarity relative to ground, with a load current of 0-2 A. The collector of the transit pentode has a power rating of 25 kW. Figures 1. [287-2415]

UDC 621.314.632

PARALLEL INVERTER WITH BLOCKABLE THYRISTORS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 29 Mar 82) pp 97-98

GLUZMAN, P. L., CHERNYKH, Yu. A. and YUDIN, V. V., Rybinsk Institute of Aviation Technology

[Abstract] A parallel inverter bridge for power supplies with intermediate frequency conversion is described in which both pairs of thyristors will not be fired simultaneously so as to short-circuit the voltage source. The necessary time delay between blocking one pair and then firing the other is achieved by having the load connected into the a.c. diagonal and the d.c. source connected to the d.c. diagonal. An added control consists of a clock-pulse generator with a frequency regulating RC-network, a binary pulse counter, a decoder, and two amplifiers. A transistor-diode switch is connected across each of two primaries of the two pulse transformers, the secondaries of the latter being connected to the thyristor gates. The device can invert d.c. voltages of 10-400 V and has a maximum load capacity of 2 A a.c. at frequencies up to 4 kHz. Figures 2; references: 2 Russian. [287-2415]

UDC 621.373

SHAPER OF SQUARE VOLTAGE PULSES WITH INDUCTIVE ENERGY STORAGE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83
(manuscript received 4 Jan 82) pp 80-82

AGADZHANYAN, S. V., GRIGOR'YEV, I. N., LAPSHIN, Ye. I. and POLYAKOV, Ye. A.

[Abstract] A shaper of square voltage pulses is described which consists of a discharger generating a constant current of adjustable magnitude and polarity, a large inductance coil for energy storage, an oil-filled high-speed contactor with inductive-dynamic drive, two gas-discharge commutating switches, and a voltage stabilizer with very nonlinear ZnO resistors. The gas-discharge switches shape the leading edge and the trailing edge of a pulse, each contains two symmetric hollow cylindrical electrodes with a set of insulating diaphragms between them inside a hydrogen-filled (10^{-3}-10^{-2} torr) and hermetically sealed space. They are placed in a constant longitudinal magnetic field of a solenoid. Each discharge tube is triggered into conduction by its igniter through a third electrode inside the hollow one of appropriate polarity. The extra energy required for shaping square pulses and dissipated in the nonlinear resistors decreases with increasing pulse duration, becoming minimum at the maximum possible "flat top" pulse duration proportional to the inductance. The device can generate voltage pulses of 50 kV and 50 ms duration with a current of 500 A. Its advantages over long pulse-shaping lines are simpler matching of source and load parameters, smaller size, and easy shaping of steep edges of long pulses. Figures 3; references: 8 Russian.
[287-2415]

UDC 621.373

HIGH-CURRENT 3-MV CLIPPING DISCHARGER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83
(manuscript received 16 Jul 81) pp 83-85

BASTRIKOV, A. N., KOVAL'CHUK, B. M., KOKSHENEV, V. A., MANYLOV, V. I., PODKOVYROV, V. G. and POTALITSYN, Yu. F., Institute of High-Current Electronics, Siberian Department, USSR Academy of Sciences, Tomsk

[Abstract] A clipping thyratron is described which shapes quasi-square microsecond voltage pulses of up to 3 MV across a resistive load. It does not contain a dielectric sleeve, but the two Duralumin main electrodes (one grounded) are mounted inside a polyethylene insulator yoke. The inter-electrode gap is 9 cm long and filled with nitrogen or N_2 + SF_6 mixture. The discharger operates with a 33-stage Arkad'yev-Marx generator. It is triggered and controlled, through an igniter electrode inside the ground main one, by a 5-stage Arkad'yev-Marx generator with a pulse edge sharpening

gap. Auxiliary components include a 5 μH damping inductance, a 10^4 ohm charging resistor, a 5 μH overvoltage limiting shunt inductance, and a 100 Mohm divider resistance with a 0.1 ohm low-voltage arm. The device was tested with an electrolyte as load: water solution of NaCl inside a polyethylene tube, with the resistance regulared by varying the salt concentration. The electric strength of the discharger was raised to 3.3 MV by lengthening the gap to 12 cm and filling it with SF_6 to a pressure of 9 atm. According to computer-aided calculations of the electrostatic field, the maximum electric field intensity is 155 kV/cm at the spot where the insulator yoke begins to be covered with oil. The discharger operates at a high speed, which remains stable within 2 ns. Figures 3; references 8: 5 Russian, 3 Western (2 in translation).
[287-2415]

UDC 621.374.34

CLIPPER-LIMITER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 26 Jan 82) pp 103-105

GORODETSKIY, V. M., Special Astrophysical Observatory, USSR Academy of Sciences, Leningrad branch

[Abstract] A limiter is described which combines the high degree of symmetry of a bilateral diode-type clipping circuit with the high sensitivity of a NAND logic-type limiter. It consists of three identical stages in series, each essentially a diode-type clipper followed by an aperiodic class A (nondistorting) transistor amplifier, and a NAND output stage. Germanium diodes are suitable for this application, field-effect transistors with insulated gate are suitable for the amplifiers. The overall gain is 10^4, over the 5 mV - 10 V range of input signals. The output signals are $V_{"1"} > 2.4$ V ($V_{in} > 0$) and $V_{"0"} < 0.4$ V ($V_{in} \leq 0$) with a rise time of 4-6 ns each. The limiter output matches series 131, 133, 155, 531 integrated microcircuits. Figures 3; references 3: 1 Russian, 2 Western.
[287-2415]

UDC 621.382

COMPARATOR OF INFREQUENT FAST FLUCTUATING SIGNALS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 9 Aug 80, after revision 6 Aug 81) pp 99-100

GORSHKOV, A. P.

[Abstract] A comparator of infreuqent fast fluctuating signals is described which combines high sensitivity with short switching time. This is achieved

by using a trigger as a threshold device and dividing its starting circuits into a "fast" one and a "slow" one. As a result, the product of signal time and excess voltage above reference level is held to a minimum (less than 10 mV · 3 ns). The "fast" circuit actuates the trigger with minimum time delay through a microcircuit amplifier-inverter, the "slow" circuit extends the starting pulse sufficiently long for the trigger to be fired through a pulse stretcher. The comparator also contains a microcircuit differential amplifier, a RC discharge network, and TTL logic. It can be used in detectors of infrequent signals, in stabilizers of the mean frequency of noise-like overshoots above a reference level, and in some analog-to-digital converters. Figures 2; references 3: 2 Russian, 1 Western.
[287-2415]

UDC 621.396.664

MULTICHANNEL INDICATOR OF RECORDING LEVEL

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 10 Dec 81) pp 105-107

BOKANCHA, N. S., SKOROBOGATOV, V. N. and YURCHENKO, Yu. V.

[Abstract] A multichannel 2-threshold indicator of the recording level on a magnetograph is described which monitors the mean-square signal level within the $V_{min} \leq \sigma^2 \leq V_{max}$ range, the two thresholds here being determined by the form of the signal distribution density and by the dynamic range of the magnetograph. It has four independent channels feeding into an input multiplexer, from which signals proceed to a squarer (or a device for determining the modulus of the signal, if the latter is known to have a normal distribution). There follows an RC integrator with a demultiplexer and an output multiplexer feeding into an operational amplifier. The integrator is also connected to two comparators, for comparison with the upper limit and the lower limit respectively. Each multiplexer is controlled by a pulse generator built on two inverters and followed by a binary counter. The indicator panel contains four arrays of light-emitting diodes. The instrument draws a power not exceeding 0.4 W. The multiplexer of input signals has a range of ± 1 V and a frequency 1 kHz, the multiplexer of output signals has a range of 0-1 V and a frequency of 0.3 Hz. The transmission coefficients of all channels are identical within 1%, the triggering thresholds of the diode arrays differ by not more than 1 dB, there is a 6 dB difference between upper threshold and lower threshold. Figures 1; references: 1 Russian.
[287-2415]

UDC 681.335.2

FOUR-STROKE INTEGRATING ANALOG-TO-DIGITAL CONVERTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83
(manuscript received 16 Mar 82) pp 86-89

BELENKOV, O. V., Ural Polytechnic Institute, Sverdlovsk

[Abstract] A four-stroke integrating analog-to-digital converter is described which features digital rather than analog correction of temperature and time instability of the null level. It requires only one trimming resistor for setting the slope of the conversion characteristic, the null characteristic of conversion being set automatically. It consists of three stages with an operational amplifier each (buffer, integrator, comparator) with five analog switches, a 6 MHz frequency setting oscillator, a modulo-12 counter, a modulo-$2 \cdot 10^4$ counter, a reversible counter, and a control unit. In the first stroke the null level is integrated. In the third stroke the input voltage is integrated. In both second and four strokes numbers N_1 and N_2, respectively, are registered in the reversible counter. These numbers depend on the null shift voltages in the three stages, on the integrator feedback circuit parameters, on the difference between integrator input currents, on the capacity of the modulo-$2 \cdot 10^4$ counter, and on the frequency of counting pulses. Counters and operational amplifiers are built with integrated microcircuits. Other components include three transistors, five diodes, six resistors, and one capacitor. The device has a 10^4 resolution (not counting the sign) and a speed of 4 conversions/s. Its error does not exceed 0.03% at input voltages within the ± 1 V range and temperatures within the 15-40°C range. It has been used one year in testing magnetic materials. Figures 3; references: 3 Russian.
[287-2415]

UDC 535.853.621.3.029.65

SPECTROPOLARIMETER OF MAGNETIC RESONANCE AT MILLIMETRIC WAVELENGTHS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 2 Nov 81) pp 127-129

VERTIY, A. A., DERKACH, V. N., POPKOV, Yu. P. and SHESTOPALOV, V. P., Institute of Radiophysics and Electronics, UkSSR Academy of Sciences, Kharkov

[Abstract] A multichannel spectropolarimeter of magnetic resonance is described which has been designed for analyzing magnetooptical phenomena and absorption spectra as well as for measuring concentrations of paramagnetic centers. It consists of a diffraction radiation generator as a microwave source, which obviates the need for automatic frequency and power control, followed by a p-i-n modulator, an attenuator, a phase shifter, and a semisymmetric open resonator. The instrument can operate in two modes, continuous mode with automatic recording of polarization ellipses and absorption spectra, or discrete mode of measuring angles of rotation of polarization planes. For operation in the continuous mode as conventional spectrometer, an interchangeable plane reflector is used which consists of a movable peripheral part and a stationary phase-correcting central part. The test substance is placed on that stationary central part, the position of the latter relative to the mirror being adjustable for optimum phase compensation and maximum Q-factor. For operation in the discrete mode, a polarizing plane mirror film deposited on a quartz substrate serves as reflector. Electromagnetic radiation then passes through the semitransparent polarizer to a rectangular horn antenna and from here to a detector. The resonator cell, containing a plane reflector with two orthogonal coupling slits and a quartz tube with the test substance, is placed in a cryostat at 4.2 K. The maximum sensitivity of the instrument as polarization rotation meter, defined as the minimum number of detectable spins per unit specimen volume, depends on the wavelength of light and the width of the absorption line, on the temperature of the specimen and the dielectric permittivity of its material, and on the microwave oscillator frequency. Its maximum sensitivity as an absorption spectrum analyzer, defined by a parameter directly proportional to the minimum number of detectable spins, depends on the resonator parameters. The instrument can be used for analysis of wide absorption spectra, measurement not being affected by the

dependence of the magnetic reluctivity of the test substance on the intensity of the constant magnetic field. It also reveals magnetic birefringence. Figures 4; references 6: 5 Russian, 1 Western (in translation).
[287-2415]

UDC 537.312.62

AUTOMATED CONTINUOUS RECORDING OF CHARACTERISTICS OF TECHNICAL-GRADE SUPERCONDUCTORS

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[Abstract] Continuous direct and simultaneous recording of the two basic characteristics of hard type-2 superconductors, namely their critical current $I_c(B)$ and pinning force $F_p = I_cB$ as functions of the magnetic induction B, has been automated by means of a simple arrangement which includes a relay-type regulator and a digital comparator. The specimen of a technical-grade superconductor is placed at the center of a superconducting magnet inside a cryostat and connected into the system according to the conventional four-point scheme: two current leads to a stabilized current source and two potential leads to a V-15 microvoltmeter serving as d.c. amplifier (gain $K = 10^5$, time constant $T \simeq 1$ s). The output of this amplifier is connected to a Shch68000 digital voltmeter acting as analog-to-digital converter. The comparator is built with series K155 integrated microcircuits, for comparing codes of a high-frequency NAND-logic module. It compares the amplified signal from the specimen with a digital signal which corresponds to the reference voltage and is generated by a code setter consisting of programmable PP10-MV switches. The comparator output is connected to the reference-voltage generator, the latter consisting of a tunable pulse generator, four reversible binary counters built with series K155IYe7 integrated microcircuits, and a digital-to-analog converter of the current-adder type. The critical current and the pinning force are each recorded by an XY-plotter. The instrument has been used for recording currents over the 10 A = 5 kA range of Nb + Ti, Nb_3Sn, V_3Ga multistrand wires and cables. The authors thank M. N. Apalikhin and V. L. Kolyukovskiy for assistance in debugging the system and for helpful suggestions, also G. G. Gurov and L. M. Vasil'yev for discussing the project. Figures 1; references 5: 2 Russian, 3 Western (1 in translation).
[287-2415]

UDC 539.1.074.4

TOOL FOR PRODUCING LARGE THIN SPHERICAL MIRRORS

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[Abstract] A simple tool has been developed for producing in the laboratory large spherical mirrors of thermoplastic material with a small ratio of mass to surface area. A disk of acrylic glass, together with a thin sheet of aluminum acting as elastic membrane, is clamped between two circular flanges by means of tightening bolts. The assembly is placed in a furnace, preferably a wooden box heated with 500 W light bulbs to 120-150°C. After the material has softened, pressure is applied at the center so that the disk deflects, whereupon the disk is cooled under constant pressure so that it retains its new (spherical) shape. Nonspherical mirrors can also be produced with took, by using an aluminum sheet with the appropriate (analytically designed) thickness profile. Figures 1; references 4: 2 Russian, 2 Western. [287-2415]

UDC 621.373.431

GENERATOR OF HIGH-VOLTAGE NANOSECOND PULSES

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AKIMOV, Yu. A., ANDREYEVA, L. I., BUROV, A. A., KAYDALOV, S. A., KALININ, Yu. M. and KORCHAGIN, M. V.

[Abstract] A controllable secondary-electron current multiplier ELU-OK has been developed for generating high-voltage nanosecond pulses with a very short time delay between input and output. Its output characteristic has a slope of 10-100 A/V. A master generator produces pulses at a repetition rate of 1 kHz with sharpening of the leading edge and with adjustable duration, which are preamplified to 100 V amplitude with 6 ns rise time before being applied to the control electrode of the 8ELU-KO device. The latter produces at the output two pulses of respectively positive and negative polarity, 400-1200 V amplitude, and 15-500 ns duration at a repetition rate of 1-1000 Hz. A ferrite pulse sharpener at the output reduces the rise time to 1 ns. The time delay from input to output is a few nanoseconds, with an intrinsic stability within 10^{-11} s. The master generator is triggered either internally or by a 50 V - 1-3 μs pulse from a standard generator. The 8ELU-KO set is built as a self-contained functional module and can operate with either a matched (75 ohm) or capacitive load. Figures 1. [287-2415]

UDC 621.315.687

VACUUM-TYPE HIGH-VOLTAGE CABLE BUSHING

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 22 Mar 82) p 168

GRIGOR'YEV, Yu, V.

[Abstract] A high-voltage cable bushing is described which, while smaller and lighter than an open connector, combines safe handling with easy repair. The isolator is made of acrylic glass or ftoroplast [polytetrafluorethylene = = Soviet equivalent of Teflon-4]. The conductor is soldered to a pin inside the isolator, the braid is pressed between an isolator shoulder and a sleeve on the outside. There are two O-ring vacuum seals made of rubber or indium: one inside between isolator shoulder and the pin, one between an isolator shoulder and a retainer on the outside. The retainer is either soldered to a vacuum chamber of coupled to it through a muchroom seal. With a VA05-4 suction pump with a trap cooled by liquid nitrogen, the vacuum chamber can hold the pressure down to 10^{-6} torr in four such isolator retainers connected to it. The bushing with coaxial cables RK-75-9-13 and RK-50-7-21 carrying 6 A and 20 A respectively has an electric strength of 100 kV (minus cable voltage). Figures 1.
[287-2415]

UDC 621.375.826+62-52

SOFTWARE AND HARDWARE FOR CONTROL OF ALIGNMENTS IN OPTICAL CHANNEL OF LASER SET

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 83 (manuscript received 20 May 81) pp 152-155

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[Abstract] The feasibility of automatically aligning the laser beam in "Del'fin" equipment has been established experimentally and analyzed in a study with a control beam from an LTI-501 garnet (Nd^+) single-mode continuous-wave laser (power 8 W). This laser beam is widened by a collimator to a diameter of 45 mm with a 20" divergence and its intensity is modulated by a mechanical shutter. It entrance into the optical channel of the main power-laser beam is controlled by a semitransparent tiltable mirror for correction in two angular coordinates. This mirror is the principal element of an automatic control system consisting of a CAMAC crate (with five modules: two stepper-motor synchro drives, guidance logic, 3932 U-port adapter, 9080 bus controller) with a PDP-11/04 computer and with feedback through a square-law photodetector and a semitransparent 45° fixed mirror. The performance of this automatic alignment system was tested with an auxiliary beam from a He-Ne laser having a 20" divergence. This beam entered into the optical channel collinearly with the beam from the garnet laser. Measurements and calculation of the minimum analge error indicate than an alignment precision within 1" is feasible. The system can also be used for automatic superposition or centering of optical components or beams relative to some datum. Figures 4; references 9: 7 Russian, 2 Western.
[287-2415]

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